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GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
LANSING



C. HEIDI GREETHER
DIRECTOR

October 10, 2018

VIA E-MAIL

Mr. Barry June, Director
Genesee County Parks and Recreation Commission
5045 Stanley Road
Flint, Michigan 48506

Dear Mr. June:

SUBJECT: Hydraulic Model and Report - HND-CCW3-ER0MN
Barry June, Genesee County Parks and Recreation Commission

This letter is to act as a supplement to our Second Correction Request letter regarding DEQ File No. HND-CCW3-ER0MN, also dated October 10, 2018, and to provide additional details of the Water Resources Division's (WRD's) concerns with the current hydraulic model and report submitted with the Joint Permit Application. A thorough review of the hydraulic model and report has uncovered several deficiencies that will need to be addressed in order to adequately characterize impacts resulting from the proposed project. A summary of these deficiencies, and associated recommended actions, are as follows:

- Please note that FEMA will require DEQ approval of the LOMR application and hydraulic models proposed in the LOMR process. As such, please provide the following models and reports that address in detail the differences among these models:
 - Duplicate Effective- recreates FEMA's effective model (ca. 1980) in current modeling software
 - Corrective Effective Model (CEM)- using Duplicate Effective model as a starting point but inserts structures and better survey data that was not included in the original FEMA model. As requested by FEMA in Feb 2018, this model would have all 6 gates at Hamilton Dam as in the original model. The City of Flint has not updated the FEMA study through the LOMR process to bring it up to current conditions. The CEM cannot contain any man made/caused changes since the effective model was completed.
 - Existing Conditions - current field conditions as in CEM; however, it will also incorporate DEQ permitted changes such as weir at Hamilton Dam and Consumers Energy dredge and cap project, since a LOMR has not been obtained from the FEMA.
 - Proposed Conditions - includes any changes proposed as part of the river restoration project, happening since the completion of any previous projects.

- Inconsistent methodologies for determining and application of Manning's roughness coefficient (n):
 - The existing conditions model utilizes horizontal variation of n values consistent with recommendations of Chow and others. The proposed conditions model utilizes the same horizontal variation of n values when cross-sections remain unchanged; however, the model also utilizes a vertical variation of n values when modifications to the channel are proposed. It is not appropriate to change methodology for determining and applying n values as this would diminish the model's ability to accurately characterize impacts resulting from the proposed channel modifications. Methodology and application of n values should be consistent throughout (all cross-sections) both models. Please revise the model and report to reflect this recommendation.
 - According to the hydraulic report, vertical variations of n values were calculated using Rosgen Geomorphic Channel Design method. DEQ has reviewed the method and confirmed with Mr. Rosgen that is an inappropriate application of the method. Equation 11-1, cited in the hydraulic report and in the National Engineering Handbook, provides an empirical equation for calculating a resistance factor (u/u^*) for existing cross-sections where the channel dimensions, bed material gradation, and flow rates have been measured at a natural riffle. From that data, the method then allows for back-calculation of an effective n value for the channel at that location and flow rate. The application in the hydraulic report is for modeled cross-sections where hydraulic radius and flow rate have not been measured. Therefore, this method should not be used.
- Use of blocked obstructions to transpose crest elevations of the proposed structures:
 - Blocked obstructions have been utilized at several cross-sections in the proposed conditions model to mimic the crest of proposed structures when those structures do not run perpendicular to the direction of flood flows. Though this is an appropriate application for blocked obstructions, there are several issues with their application in the proposed conditions model.
 - The proposed structures include crest elevations that are varied across the channel width. Though, the blocked obstructions do not reflect these changes in crest elevation. Please revise all blocked obstructions such that the proposed crest elevations are reflected.
 - There are several different gradations of fill proposed for the structures, however, the blocked obstructions generally use only one or two different n values. Please add additional stations to the blocked obstructions with varied n values to reflect these different material gradations.
- Consistency with Duplicate Effective/Corrected Effective models to be utilized in the FEMA LOMR/CLOMR process:

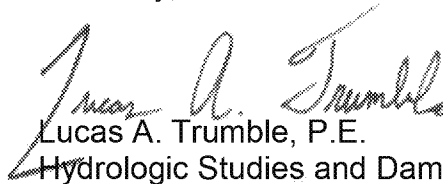
- For consistency with the existing conditions model, for expedition of the model review, and for consistency with the FEMA LOMR/CLOMR process, it is strongly recommended that the proposed conditions model be revised to include horizontal variation of Manning's n values as outlined in the USGS Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains (Arcement & Schneider, 1989), or Chow.
- Adequate characterization of the proposed fill:
 - The first Correction Request Letter, dated May 25, 2018, requested that additional cross-sections be added to the proposed conditions model to adequately capture the complex geometries and hydraulics associated with the proposed riffle structures. That letter recommended a minimum of two additional cross-sections at both the upstream and downstream transitional areas.
 - The September 20, 2018, response letter indicated that nine additional cross-sections have been added to the proposed conditions model for this purpose.
 - However, the project, as proposed, would include installation of nine in-stream structures. These structures are typically characterized in the model by three cross-sections: one at the upstream toe, one at (or representative of) the crest, and one at the downstream toe. Several additional cross-sections should be added for each proposed structure, when linear interpolation between cross-sections as performed by the 1D model will not adequately capture the complexities of the fill and hydraulics. These should include, at a minimum, cross-sections in the unmodified channel upstream and downstream of the structure, at least two cross-sections at both the upstream and downstream transitional sections of the riffle, one cross-section at (or representative of) the riffle crest, and additional cross-sections, as needed to capture complexities of the structures.
- Other:
 - The hydraulic report listed the elevation conversion used as NGVD – 0.502 ft = NAVD88. This is slightly different from what FEMA used (-0.47 feet) in the approved FIS. Please provide an explanation of the datum discrepancies and why it varies from the FEMA published data.
 - Upstream of the Hamilton Dam, the Q100 decreases from 11,800 to 11,500 cfs. But no supporting justification is provided. The discharge from Hydrologic Studies Unit (HSU) provided does not state this, nor does the FIS. All flows used in the hydraulic model need to be provided by HSU.
 - Section 2.4.1 of the hydraulic report indicates that cross-sections were removed from what is referred to as the Corrected Effective Model (CEM – 2010 Stantec model). Please provide a detailed explanation of why these cross-sections were removed. In general, cross-sections should not be

removed from a previously reviewed and approved model. Doing so would alter the model results and require additional review and approval. Adding additional cross-sections for the project would be appropriate.

- Supply a detailed cross-section location map(s) that show the location of all cross-sections as well as existing and proposed contours. Without this, it's impossible to see if the cross-sections are in appropriate locations to model the project activities. The project reach will likely need to be broken up in several maps to make them legible. The maps provided in Appendix C "Hydraulic Model XS Planview" (pgs. 21-27 of 38) are insufficient as they do not legibly show existing and proposed grades.
- Reach boundary conditions should be known WSEL for the 100-year profile for all runs and should tie into the FEMA flood insurance study at a downstream cross-section.
- XS 37730 is just downstream of Carpenter Road and the entire XS (1200 feet wide) is shown as effective flow vs the upstream cross-section at the road where the flow is only about 150 feet wide. Ineffective Flow Areas (IFAs) should be added.
- No IFAs are shown around M-54, Dort Hwy (XS 25436). IFAs should be added.
- The models are run using a subcritical flow regime. All models should be run using mixed flow so that subcritical, critical, and supercritical flow areas are captured.

If you have any questions regarding this letter or your application, please contact me at 517-420-8923 or trumblel@michigan.gov. Send the requested information to me at DEQ, WRD, Hydrologic Studies and Dam Safety Unit, 525 West Allegan Street, 3rd Floor, South Tower, Lansing, Michigan 48933. Please include your submission number HND-CCW3-ER0MN, in your response. The status of your application can be tracked online at <https://miwaters.deq.state.mi.us/miwaters/>.

Sincerely,



Lucas A. Trumble, P.E.
Hydrologic Studies and Dam Safety Unit
Water Resources Division
517-420-8923

cc: Dr. Karen Weaver, City of Flint
Mr. Mark Adas, P.E., City of Flint

Mr. Barry June
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Mr. Jason Kenyon, P.E., Wade Trim
Mr. Jason Carey, P.E., River Restoration
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